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By:

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Dated: April 6, 2001

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Derflinger, et al.
Parent Appln. No. : 09/253,212
Filing Date : April 2, 2001
For : METHOD FOR PRODUCING CUTTING TOOLS
Examiner in Parent : Tsai, H.
Group Art Unit : 3722

BOX PATENT APPLICATION
Commissioner for Patents
Washington, D.C. 20231

PRELIMINARY AMENDMENT

Sir:

In advance of the first Office Action in this divisional
application of parent application no. 09/253,212, please amend the
same as follows:

IN THE SPECIFICATION:

Please replace the specification originally filed with the attached Substitute Specification. The attached copy of the original specification is marked-up to show where the amendments have been made and the under-signed verifies that no new matter has been added by this amendment.

IN THE CLAIMS:

Cancel claims 1-18 (all the and claims originally filed) and add the following process claims, noting that the original process claims were subjected to a restriction requirement on November 17, 1999 and were canceled:

--19. A method for producing cutting tools comprising the steps of:

providing on a first region of a tool body that contains at least one first cutting edge, a first hard material coating by means of a plasma vacuum coating process;

providing on a second region of said tool body that is adjacent said first region, a second hard material coating by means of said plasma vacuum coating process;

selecting as hard material for said first and second hard material coatings, a material selected from the group consisting of: carbide, oxide, oxycarbide, nitride, nitrocarbide, oxinitride

and nitrooxycarbide, of at least two of the metal elements Ti, Zr, Hf, V, Nb, Ta, Cr, Mo, W and Al;

selecting said first hard material coating to have a content at least two of said metal elements which is at most 2at% different from a content of said at least two metal elements in said second hard material coating if the tool being produced must fulfill a requirement of high adhesive strength of the first hard material coating to a higher degree than a requirement of hardness of said first hard material coating; and

selecting said first hard material coating to have the content of said at least two metal elements to be different from the content of said two metal elements of said second hard material coating by more than 2at% if the tool being produced must fulfill a requirement of high hardness of said first hard material coating to a higher degree than a requirement of high adhesive strength of said first hard material coating.

20. The method of claim 19, further comprising the step of depositing at least as a part of said hard material coatings a (Ti,Al)N coating on said tool body.

21. The method of claim 20, further comprising the step of providing an intermediate layer between said tool body and said hard material coatings.

22. The method of claim 19, further comprising the step of depositing said hard material coatings by means of arc evaporation.

23. The method of claim 19, further comprising the step of realizing said first hard material coating to have a content of said at least two metal elements that is different from said content of said metal elements in said second hard material coating by at most 2at% by establishing a ratio of a bias voltage applied to said tool body during said coating process with respect to an electric reference potential for a plasma discharge of said plasma vacuum coating process with respect to partial pressure of a reactive gas in a process atmosphere of said plasma vacuum coating process to be:

$$1 \times 10^3 \leq U_{\text{bias}} / P_{\text{reactive}} \leq 4 \times 10^3$$

wherein voltage unit is volt and pressure unit is mbar, and wherein U_{bias} stands for said bias voltage and P_{reactive} stands for said partial pressure.

24. The method of claim 23 including selecting ground potential as said electric reference potential.

25. The method of claim 19, including selecting said

first hard material coating to have a content of said at least two metal elements at most 2at% different from said content of said metal elements in said second hard material coating for tool bodies of drills, roughing milling cutters, peripheral milling cutters, tools for hobbing machines or turning tools.

26. The method of claim 19, further comprising the step of applying said first hard material coating to have a content of said at least two metal elements to be different from said content of said at least two metal elements of said second hard material coating by more than 2at% for tool bodies of front-end milling cutters or of ball-end milling cutters.

27. The method of claim 19, further comprising the step of applying said first hard material coating with a content of said at least two metal elements to be different by at most 2at% with respect to said content of said at least two metal elements of said second hard material coating for tool bodies of tools for cutting with a larger cross-sectional area of the cut at a lower cutting rate and

applying said first hard material coating with a content of said at least two metal elements to be different by more than 2at% with respect to the content of said at least two metal elements in said second hard material coating for tool bodies for tools for cutting with smaller cross-sectional area of the cut at a larger cutting rate.

28. The method of claim 19, further comprising the step of applying said first hard material coating to have a content of said at least two metal elements to be different from said content of said at least two metal elements in said second hard material coating by at most 2at% for tool bodies of tools for cutting workpiece material having a hardness of up to at most 45 Rockwell and a tensile strength of up to at most 1500 Nmm^{-2} .

29. The method of claim 28, wherein said tool bodies are tool bodies of tools for working quenched steels, highly alloyed steels, stainless steels or non-ferrous metals.

30. The method of claim 19, further comprising the step of applying said first hard material coating to have a content of said at least two metal elements to be different

from said content of said at least two metal elements in said second hard material coating by at most 2at% for tool bodies for tools, the cutting edge thereof being loaded simultaneously with different cutting speeds relative to a worked workpiece.

31. The method of claim 30, wherein the tool to be produced is a drill where minimum cutting speed occurs at a tip of the drill and significantly higher cutting speed occurs at a circumference of the drill.

32. The method of claim 19, further comprising the step of applying said first hard material coating to have a content of said at least two metal elements to be different from said content of said at least two metal elements in said second hard material coating by more than 2at% for tool bodies of tools for cutting workpiece materials having a hardness of more than 45 Rockwell and a tensile strength of more than 1500 Nmm^{-2} .

33. The method of claim 32, wherein the tool body is a tool body for a tool for hard chipping.

34. The method of claim 19, further comprising the step of applying said first hard material coating to have a content of said at least two metal elements to be different from said content of said at least two metal elements in said second hard material coating by at most 2at% for tool bodies for the following tools:

indexable inserts for turning tools and for working material AISI 304 SS or DIN 1.4306;

indexable inserts for peripheral milling cutters for working material AISI 4140 or DIN 1.7226;

indexable inserts SEE42TN for milling cutters for working material SKD 61 (HRC 45);

hard metal roughing shank-type milling cutters for working material DIN 1.2344 to be worked in dry working;

HSS drills for working material AISI D3 or DIN 1.2080 as well as GG25 to be worked with emulsion lubrication.

35. The method of claim 19, further comprising the step of applying said first hard material coating to have a content of said at least two metal elements to be different from said content of said at least two metal elements in said second hard material coating by more than 2 at % for

tool bodies of the following tools:

hard metal roughing shank-type milling cutters for working materials DIN 1.2311 to be worked with emulsion lubrication;

hard metal ball-end milling cutters for working material AISI D2 or DIN 1.2379;

hard metal ball-end milling cutters J97 (Jabro) for dry working of DIN 1.2343, 49.5 HRC materials.

36. The method of claim 19, wherein said first and second hard material coatings comprise at least one (Ti,Al)N layer.

37. The method of claim 19, thereby selecting said first hard material coating to have a content of said at least two metal element which is at most 1at% different from the content of said at least two metal elements in said second hard material coating, if said tool being produced must fulfill the requirement of high adhesive strength of the first hard material coating to a higher degree than the requirement of hardness of said first hard material coating.

38. The method of claim 36, wherein a content of Al in the material composition of said first hard material coating varies by less than 1at% with respect to the content of said Al in said second hard material coating, if the tool being produced must fulfill the requirement of high adhesive strength of the first hard material coating to a higher degree than the requirement of hardness of said first hard material coating, and further selecting the content of aluminum in the material composition of said first hard material coating to be from the content of said Al of said second hard material coating by more than 2at%, if said tool being produced must fulfill the requirement of high hardness of said first hard material coating to a higher degree than the requirement of high adhesive strength of said first hard material coating on said base body.--

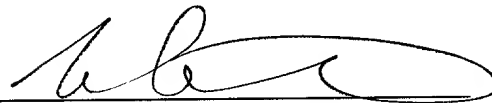
REMARKS:

Claims 19-38 are in the case and presented for consideration.

Please consider the Substitute Specification and new set of claims for examination.

Dated: April 6, 2001

Respectfully submitted,



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